Reassessing the Importance of Matching Frictions and Job Rationing in Explaining Unemployment

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Motivation

- Michaillat (2012): Job Rationing, instead of Matching frictions, is the main source of unemployment during recessions
  - Michaillat (2012) shows that unemployment will not exist as matching frictions disappear in the standard labor search-and-matching model
  - Michaillat (2012) introduces Wage Rigidity to generate Job Rationing
  - Normal Time: Unemployment 5.8%
    - Matching Frictions: 3.7% → Frictional Unemployment
    - Job Rationing: 2.1% → Frictional Unemployment
  - Bad Time: Unemployment 8%
    - Matching Frictions: 2% → Frictional Unemployment
    - Job Rationing: 6% → Frictional Unemployment
- However, Michaillat's results depend on Parameter Values and the Form of Wage Rigidity

Research Question

Michaillat's results depend on Parameter Values and the Form of Wage Rigidity

- Michaillat directly assumes model wage to be the rigid wage based on Blanchard and Galí (2010) for generating job rationing
- Michaillat calibrates his model, rather than estimates his model

Thus, I proposed a new model with different wage setting and whether the observed data supports Michaillat's assumption on wage and his calibration strategy

Analysis Approach

- I assume model wage to be a weighted average of general Nash Bargained wage and the rigid wage
  - Michaillat (2012) shows that when wage is the general Nash Bargained wage proposed by Stole and Zwiebel (1996), unemployment will not exist when matching frictions disappear
  - Michaillat (2012) assume model wage to be the rigid wage based on Blanchard and Galí (2010)
  - The weight applied to rigid wage is estimated by observed data
- I estimate my proposed model based on Bayesian methods
  - Michaillat (2012) uses Calibration to determine model parameters (including the weight applied to rigid wage)
  - $\overbrace{\text{Michaillat's Calibration}}^{\text{Prior}} + \text{Observed Data} \Rightarrow \overbrace{\text{Model Parameters}}^{\text{Posterior}}$

Findings

I begin my analysis from the Prior Density, which supports Michaillat's results

- Data do not prefer Michaillat's assumption of wage rigidity
  - The prior density of weight of rigid wage is Beta with mean 0.99 and standard deviation 0.005
  - Estimated Posterior Mean is 0.96. If the data supports wage rigidity form proposed by Michaillat (2012), we should see it is still 0.99
- Data do not prefer Michaillat's findings
  - Based on Michaillat's decomposition, job rationing is the main source accounting for unemployment during all recessions
  - Based on my estimation, rationing unemployment only exist in 1980s recessions and 2007 recession
  - Also, rationing unemployment is less than 1 percentage of total unemployment during these two recession periods
  - Data show that Matching Frictions are the main source explaining unemployment during both normal and bad time

Contributions

- Extended Unemployment Insurance (UI) & Search Effort
  - Nakajima (2012): UI $\longrightarrow$ Unemployed workers' search effort $\downarrow$
  - Zhang (2017): UI explains the increases in unemployment during the Great Recession
  - Leduc and Liu (2020): Sharp Decline in the Search Effort during the Great Recession
- Job Rationing as the main source of unemployment: More Generous UI during recessions (Michaillat 2012)
- Matching Frictions as the main source of unemployment: Different Suggestion

Outline of Talk

- Model: Similar to Michaillat (2012) but has more shocks and different wage setting
- Estimation: Data, Calibration and & Prior Distributions
- Analysis: Michaillat's Model and Estimated Model
- Conclusions

Model Equations

$$h_t = \mu_t u_t^{\xi} v_t^{1-\xi} \quad \Rightarrow \text{Matching Function}$$
$$f_t = h_t / u_t \quad \Rightarrow \text{Job Finding Rate}$$
$$q_t = h_t / v_t \quad \Rightarrow \text{Vacancy Filling Rate}$$

- h_t: New Hires
- f_t: Job Finding Rates
- q_t: Vacancy Filling Rates
- μ_t: Matching Efficiency Shock
- Parameters: Steady State of Matching Efficiency μ and matching elasticity ξ

Model Equations

$$u_t = 1 - (1 - s)n_{t-1} \quad \Rightarrow \text{Job Seekers}$$
$$n_{t+1} = (1 - s) \cdot n_t + h_t \quad \Rightarrow \text{Employment Transition}$$

- u_t: Unemployed Job Seekers
- n_t: Total Employment
- Parameters: Separation Rate s

Model Equations

$$J_t = \alpha a_t n_t^{\alpha-1} - \left(w_t + \frac{\partial w_t}{\partial n_t} n_t\right) + E_t(1-s)J_{t+1} \quad \Rightarrow \text{Job Creation Conditions}$$

$$J_t = \frac{a_t c^{\nu}}{q_t} \quad \Rightarrow \text{Free Entry}$$

- J_t: Marginal Asset Value of Filling a Vacancy
- w_t: Wage
- a_t: Technology Shock

Model Equations

$$w_t^R = \omega_t a_t^{\gamma} \quad \Rightarrow \text{Rigid Wage}$$

$$w_t^B = \frac{\eta a_t \alpha n_t^{\alpha-1}}{1-\eta(1-\alpha)} + \eta E_t(1-s)\left[\beta \frac{v_{t+1}}{u_{t+1}} a_{t+1} c^v\right] \quad \Rightarrow \text{the Generalized Bargained Wage}$$

$$w_t = \xi^w \cdot w_t^R + (1-\xi^w) \cdot w_t^B \quad \Rightarrow \text{Model Wage}$$

- w_t^R: Rigid Wage
- w_t^B: the Generalized Nash Bargained Wage
- ω_t: Wage Shock
- Parameters: Bargaining Power η, Weight of Rigid Wage: ξ^w, Vacancy Cost c^v, and rigid wage parameter γ

Rationing & Frictional Unemployment

$$J_t = \alpha a_t n_t^{\alpha-1} - \left(w_t + \frac{\partial w_t}{\partial n_t} n_t\right) + E_t(1-s)J_{t+1} \quad \Rightarrow \text{Job Creation Conditions}$$

$$J_t = \frac{a_t c^v}{q_t} \quad \Rightarrow \text{Free Entry}$$

$$w_t^R = \omega_t a_t^\gamma \quad \Rightarrow \text{Rigid Wage}$$

$$w_t^B = \frac{\eta a_t \alpha n_t^{\alpha-1}}{1-\eta(1-\alpha)} + \eta E_t(1-s)\left[\beta \frac{v_{t+1}}{u_{t+1}} a_{t+1} c^v\right] \quad \Rightarrow \text{the Generalized Bargained Wage}$$

$$w_t = \xi^w \cdot w_t^R + (1-\xi^w) \cdot w_t^B \quad \Rightarrow \text{Model Wage}$$

- As $cv \to 0$, matching frictions disappear and employment is determined by

$$\alpha a_t n_t^{\alpha-1} = \left(w_t + \frac{\partial w_t}{\partial n_t} n_t\right) \to n_t^R \text{ (Rationing Employment)}$$

- Rationing Unemployment (Job Rationing): $u_t^R = 1 - n_t^R$
- Frictional Unemployment (Matching Frictions): $u_t^F = u_t - u_t^R$
- Given $\xi^w = 1$, the decomposition results will be the same as in Michaillat (2012)

Parameters & Job Rationing

- ξ: Matching Elasticity
- μ: Matching Efficiency (steady state)
- s: Separation Rate
- c^v: Vacancy Cost
- ξ^w: Weight of Wage Rigidity
- η: Bargaining Power

Steady State Analysis: Parameters

$$J_t = \alpha a_t n_t^{\alpha-1} - \left(w_t + \frac{\partial w_t}{\partial n_t} n_t\right) + E_t(1-s)J_{t+1}$$

$$\Downarrow$$

$$\overbrace{J_t - E_t(1-s)J_{t+1}}^{\text{Recruiting Expenditure}} = \overbrace{\alpha a_t n_t^{\alpha-1} - \left(w_t + \frac{\partial w_t}{\partial n_t} n_t\right)}^{\text{Marginal Benefit}}$$

- Marginal Benefit

$$\text{Marginal Benefit} = (1-\xi^w)\cdot(((1-\eta)/(1-\eta\cdot(1-\alpha)))\cdot\alpha\cdot y/n) + \xi^w\cdot(\alpha\cdot y/n - w^R)$$

$$y = a\cdot n^{\alpha}$$

$$w^R = \omega\cdot a^{\gamma}$$

- Recruiting Expenditure

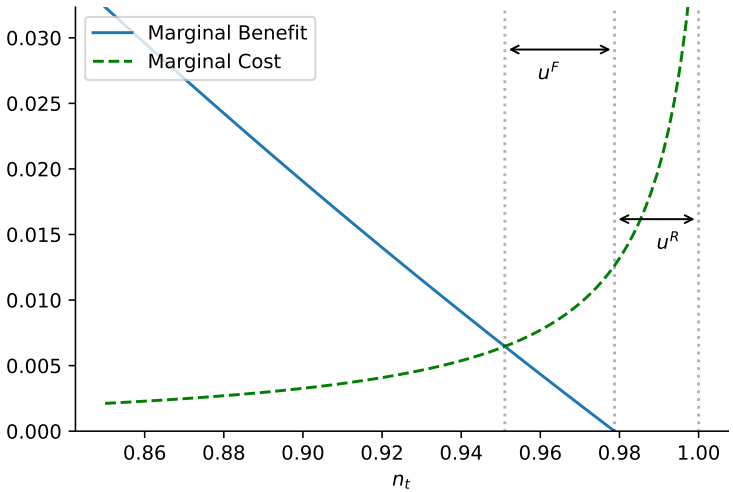
$$\text{Marginal Cost} = J - \beta\cdot(1-s)\cdot J + (1-\xi^w)\cdot\beta\cdot(1-s)\cdot\eta\cdot f\cdot J$$

$$J = a\cdot c^v/q$$

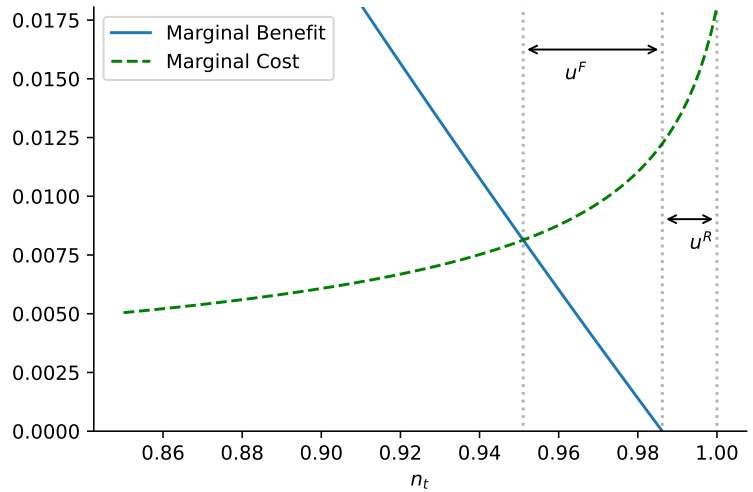
$$f = \mu\cdot(v/u)^{1-\xi}$$

- Equilibrium Unemployment: Marginal Benefit = Marginal Cost
- In Michaillat (2012), $\xi^w = 1$

Parameters: Matching Elasticity



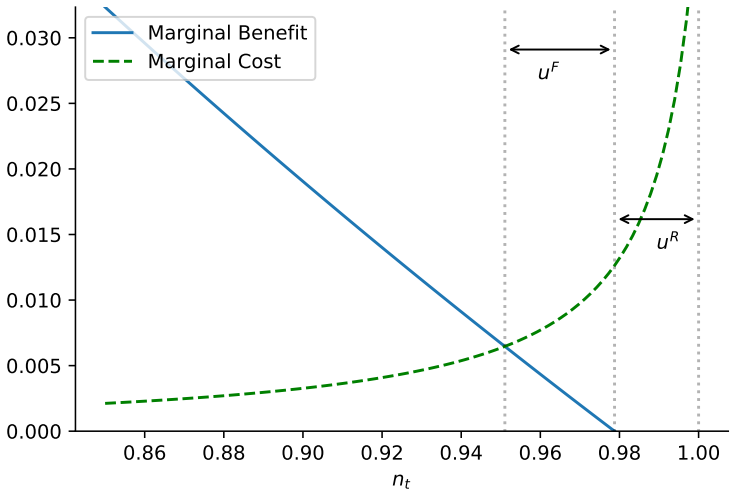
Benchmark



Lower ξ

- Equilibrium Unemployment: Marginal Benefit = Marginal Cost
- Rationing Unemployment u^R: Marginal Cost = 0
- Frictional Unemployment u^F: Total Unemployment − Rationing Unemployment
- Job Finding Rate: $f = \mu \cdot (v/u)^{1-\xi}$

Parameters: Matching Efficiency



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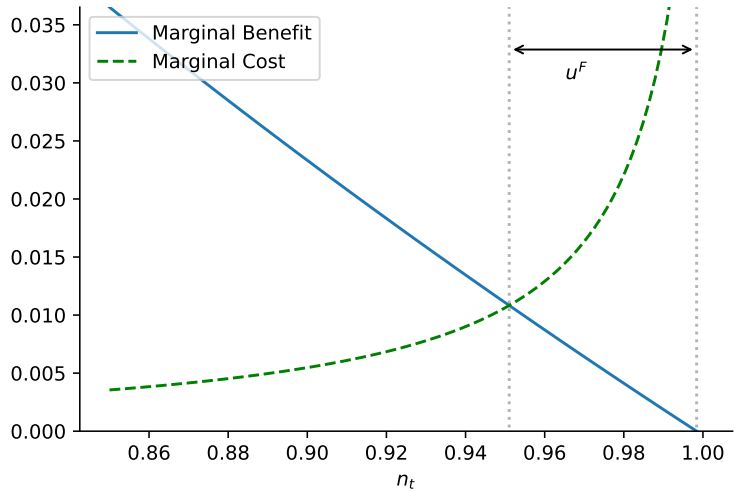
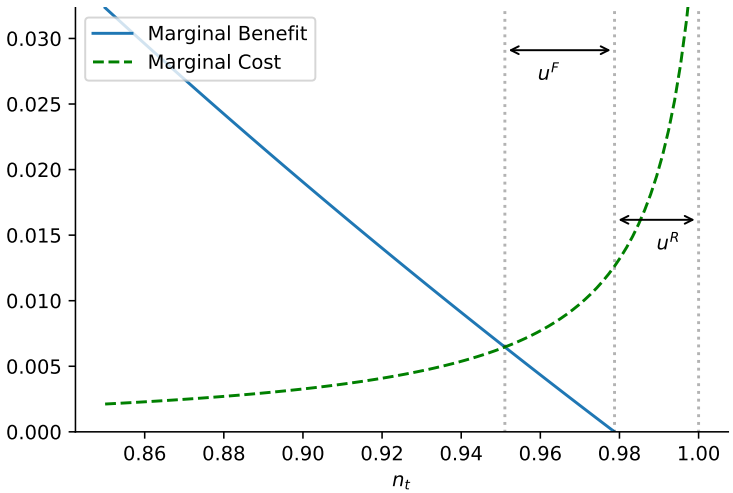


Lower μ

- Equilibrium Unemployment: Marginal Benefit = Marginal Cost
- Rationing Unemployment u^R: Marginal Cost = 0
- Frictional Unemployment u^F: Total Unemployment − Rationing Unemployment
- Job Finding Rate: $f = \mu \cdot (v/u)^{1-\xi}$

Parameters: Separation Rate



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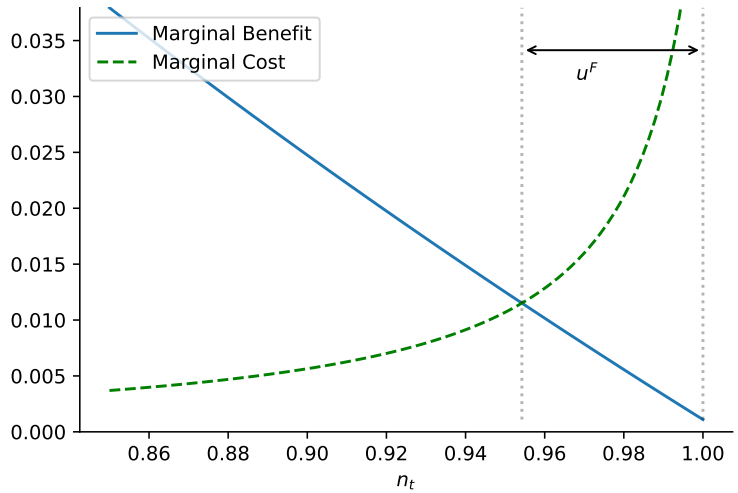
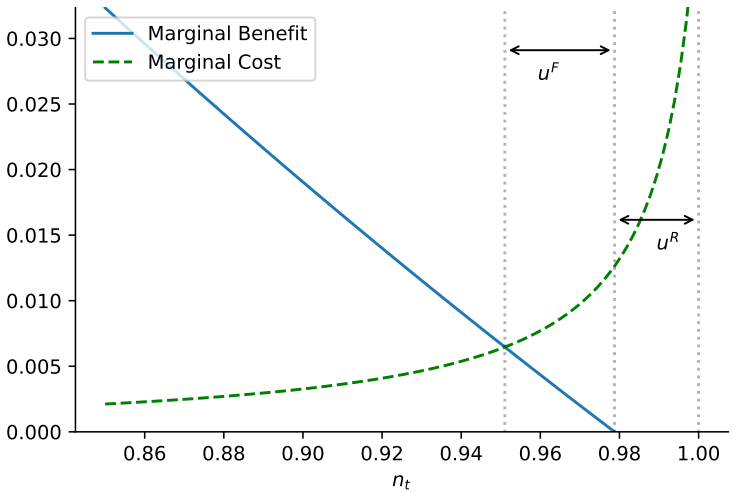


Higher s

- Equilibrium Unemployment: Marginal Benefit = Marginal Cost
- Rationing Unemployment u^R: Marginal Cost = 0
- Frictional Unemployment u^F: Total Unemployment − Rationing Unemployment

Parameters: Vacancy Cost



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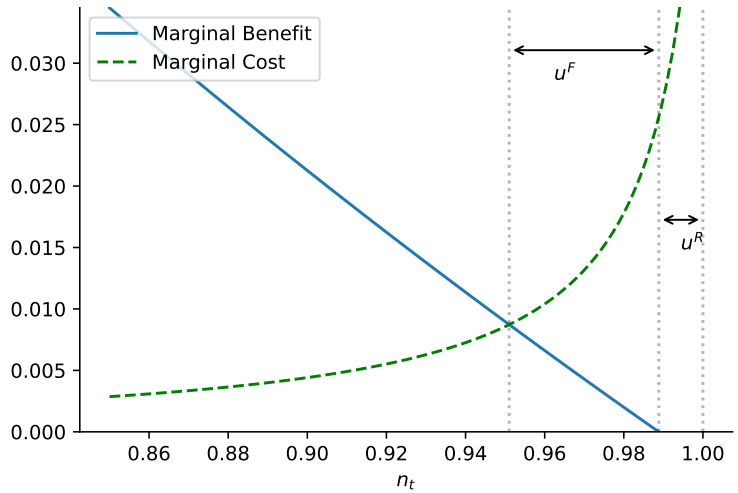
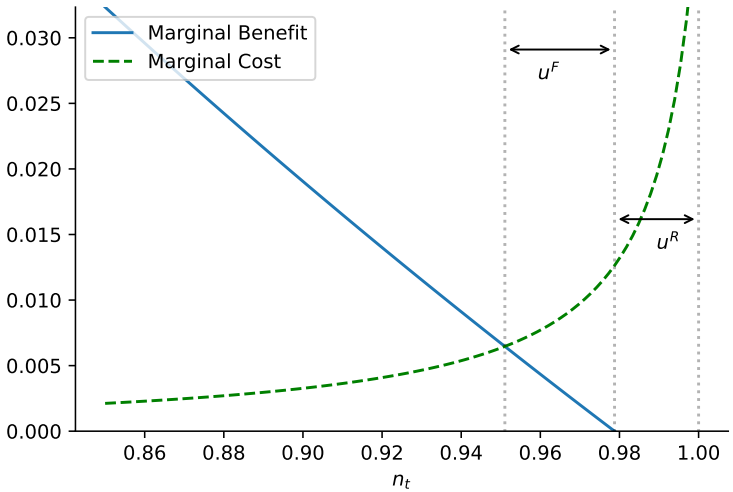


Higher c^v

- Equilibrium Unemployment: Marginal Benefit = Marginal Cost
- Rationing Unemployment u^R: Marginal Cost = 0
- Frictional Unemployment u^F: Total Unemployment − Rationing Unemployment

Parameters: Bargaining Power



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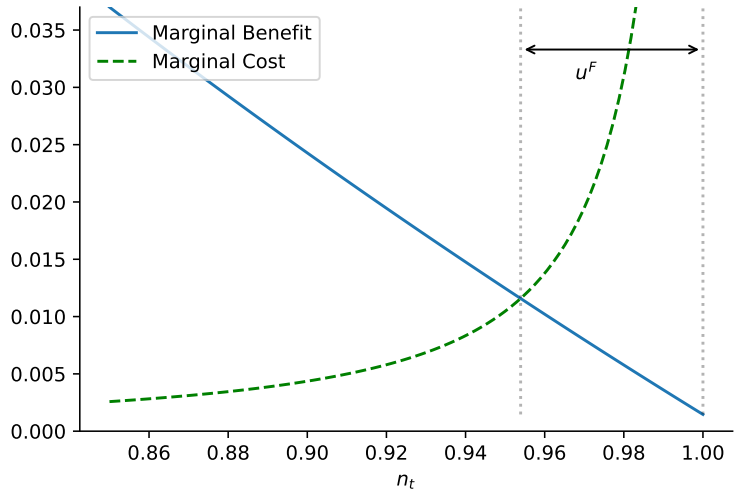
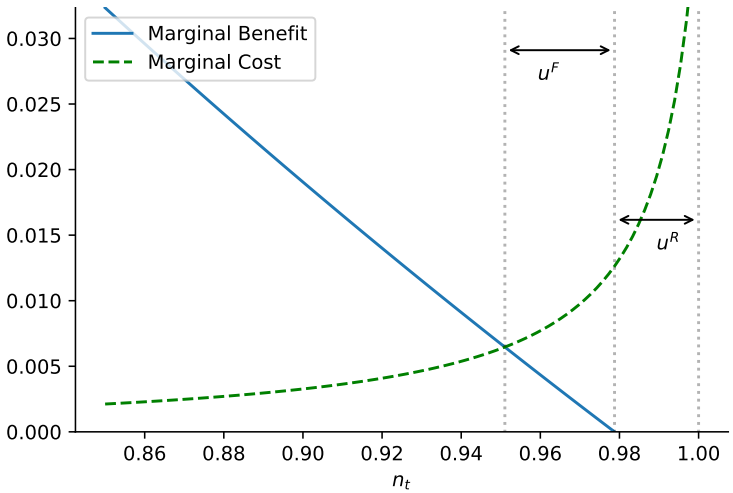


Higher η

- Equilibrium Unemployment: Marginal Benefit = Marginal Cost
- Rationing Unemployment u^R: Marginal Cost = 0
- Frictional Unemployment u^F: Total Unemployment − Rationing Unemployment
- Marginal Cost = $J - \beta \cdot (1 - s) \cdot J + (1 - \xi^w) \cdot \beta \cdot (1 - s) \cdot \eta \cdot f \cdot J$

Parameters: Weight Applied to Wage Rigidity



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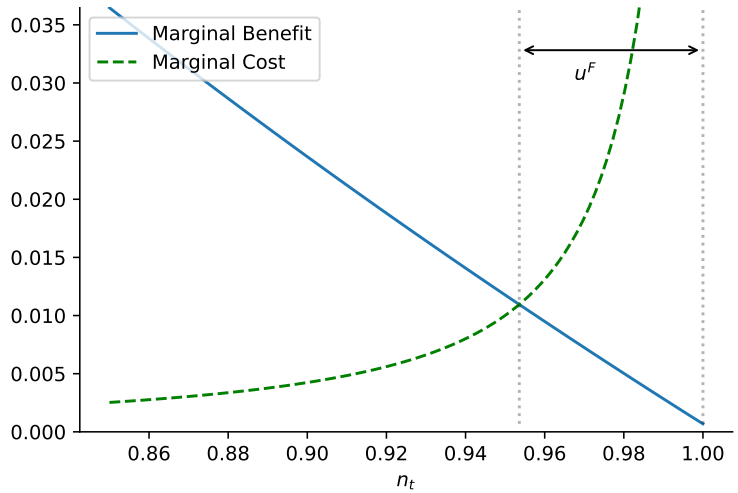


Lower ξ^w

- Equilibrium Unemployment: Marginal Benefit = Marginal Cost
- Rationing Unemployment u^R: Marginal Cost = 0
- Frictional Unemployment u^F: Total Unemployment − Rationing Unemployment

Summary

- Although I change the wage setting, rationing unemployment still can exist in my model
- The importance of job rationing in explaining the unemployment depends on following parameters
  - ξ: Matching Elasticity, $\xi \downarrow, u^R \downarrow$
  - μ: Matching Efficiency (steady state)y, $\mu \downarrow, u^R \downarrow$
  - s: Separation Rate, $\mu \uparrow, u^R \downarrow$
  - c^v: Vacancy Cost, $c^v \uparrow, u^R \downarrow$
  - ξ^w: Weight of Wage Rigidity, $\xi^w \downarrow, u^R \downarrow$
  - η: Bargaining Power, $\eta \uparrow, u^R \downarrow$

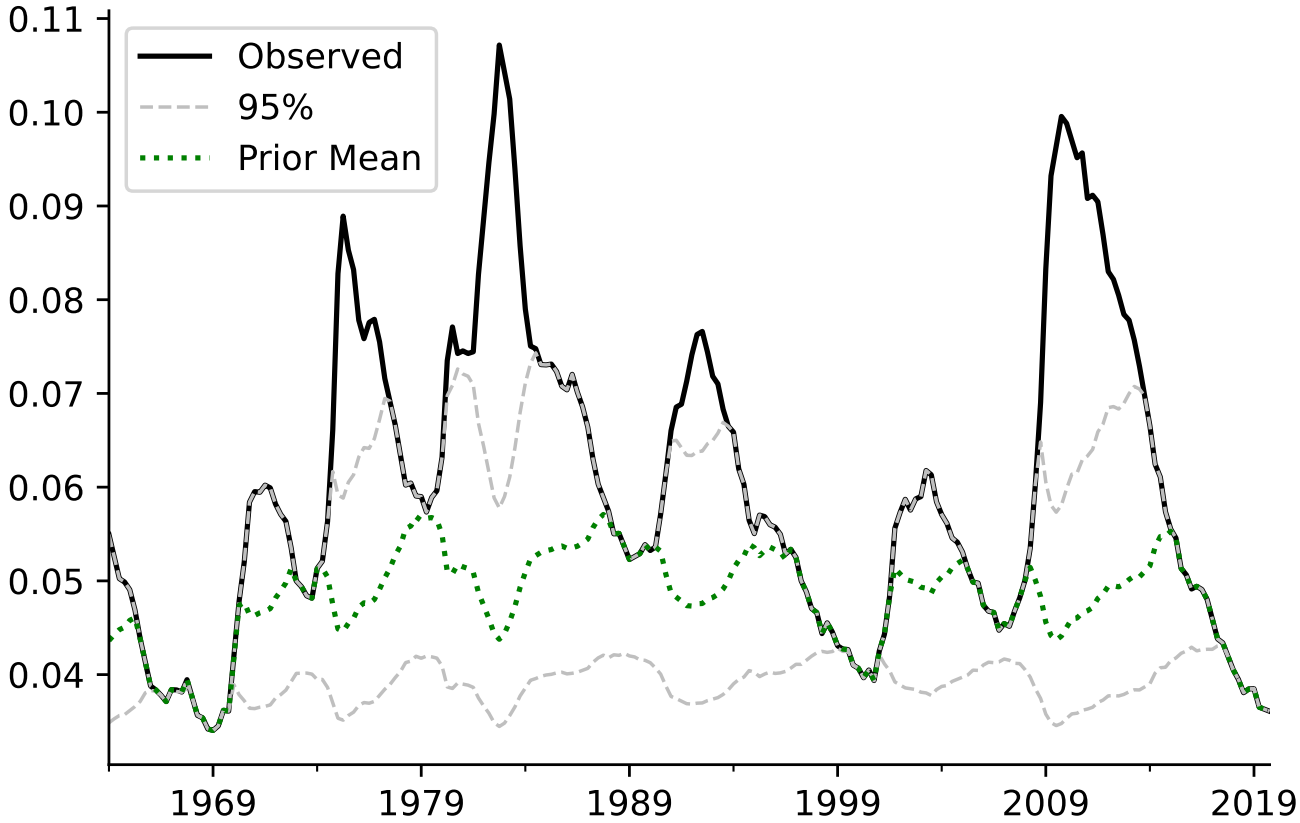
Estimation

- Three Shocks: Appendix in Michaillat (2012)
  - Matching Efficiency μ_t (Furlanetto and Groshenny 2016)
  - Technology Shock a_t
  - Wage shock ω_t
- Observed Data
  - Monthly Unemployment Rate
  - Monthly Vacancy (Barnichon 2010)
  - Monthly Real GDP or output (After 1994: Macroeconomic Advisers; Before 1994: the monthly GDP constructed by James Stock and Mark Watson)
- Difference in Model Frequency
  - Michaillat (2012): Weekly
  - We do not have weekly data, so my proposed model's frequency is monthly

Estimation Results

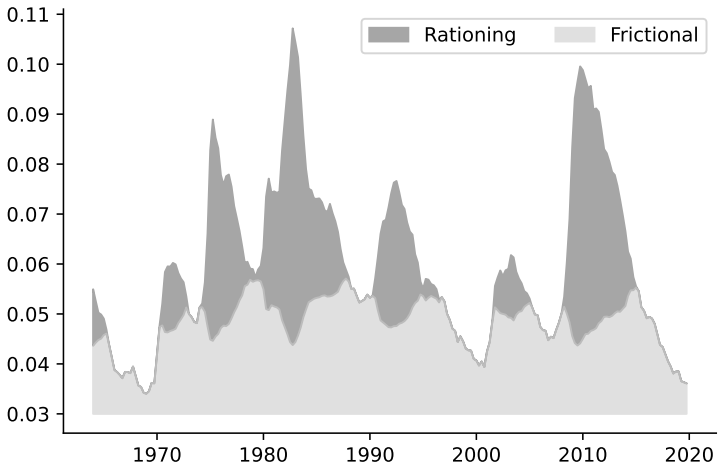
	Benchmark	Estimation	Prior Density
ξ^w	Based on Prior Mean	0.964, [0.96, 0.976]	$\mathcal{B}(0.99, 0.005)$
η	Based on Prior Mean	0.292, [0.279, 0.326]	$\mathcal{B}(0.3, 0.025)$
ξ	Based on Prior Mean	0.728, [0.735, 0.764]	$\mathcal{B}(0.5, 0.05)$
$s \cdot 10$	Based on Prior Mean	0.47, [0.45, 0.47]	$\mathcal{B}(0.3, 0.025)$
Vacancy Cost to Wage	Based on Prior Mean	0.3, [0.269, 0.336]	$\mathcal{B}(0.3, 0.025)$
μ	Based on Prior Mean	0.893, [0.806, 0.884]	$\mathcal{G}(1.0, 0.2)$
γ	Based on Prior Mean	0.978, [0.967, 0.985]	$\mathcal{B}(0.7, 0.1)$
ϕ^a	0.837, [0.819, 0.853]	0.982, [0.971, 0.991]	$\mathcal{B}(0.5, 0.2)$
ϕ^μ	0.937, [0.927, 0.947]	0.995, [0.988, 0.998]	$\mathcal{B}(0.5, 0.2)$
ϕ^w	0.987, [0.979, 0.994]	0.991, [0.983, 0.995]	$\mathcal{B}(0.5, 0.2)$
e^a	0.011, [0.011, 0.012]	0.009, [0.008, 0.009]	$\mathcal{IG}(0.01, 0.1)$
e^μ	0.069, [0.066, 0.072]	0.039, [0.038, 0.042]	$\mathcal{IG}(0.01, 0.1)$
e^w	0.001, [0.001, 0.002]	0.001, [0.001, 0.001]	$\mathcal{IG}(0.01, 0.1)$

Based on Prior Density

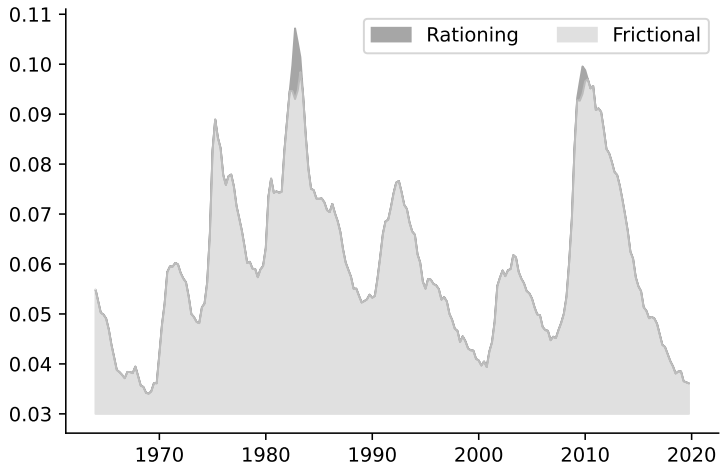


- 10^6 Draws from the Joint Prior Density
- So, the Prior Density supports Michaillat (2012), even though my model's frequency is monthly
- Based on Prior Density, the likelihood that matching frictions are the main source of unemployment is low

Prior vs Posterior



Benchmark: Prior Mean



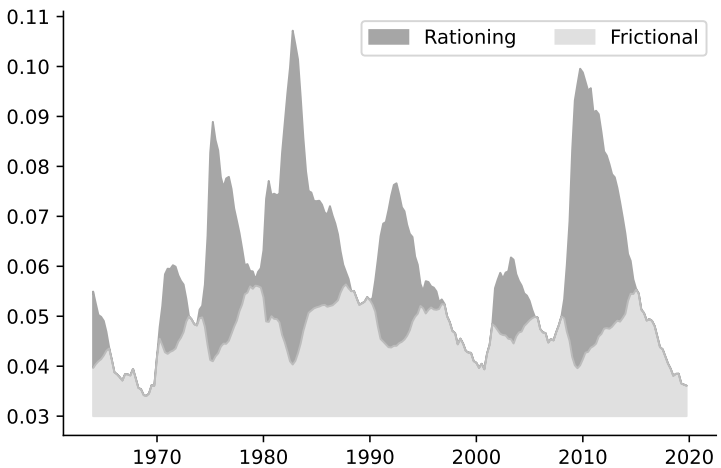
Posterior Mean

- Even though I transform parameters' frequency to weekly, the results are similar

Robustness Check

- I change the wage setting of Michaillat (2012)
- I therefore redo the estimation. I use the same wage setting as in the Michaillat (2012), and I estimate s, cv, ξ, μ, γ

Robustness Check



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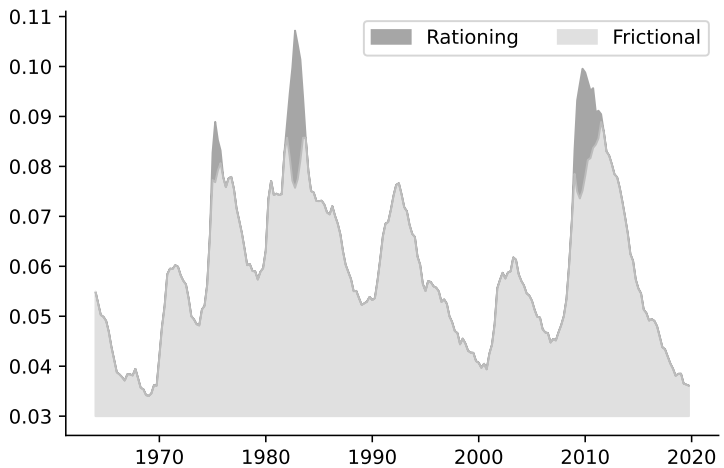

Estimated

- Again, we only have rationing unemployment during 1980s and the Great Recession
- Although job rationing is important in these two recessions, matching frictions account for the increases in the unemployment during these two recessions

Findings & Conclusion

- Although I begin from strong prior densities that prefer Michaillat (2012), the data do not support Michaillat's findings
- Based on my estimation results, matching frictions are the main source of unemployment based on Michaillat's job rationing model
- When unemployment is mainly explained by matching frictions during recessions, implement UI lowers the search effort and thus increase unemployment $\longrightarrow$ Extended UI?
- Job Rationing and Matching Frictions are unobserved. It could be due to model misspecification.

Barnichon, R., "Building a Composite Help-Wanted Index," *Economics Letters* 109 (December 2010), 175–178.

Blanchard, O. and J. Galí, "Labor Markets and Monetary Policy: A New Keynesian Model with Unemployment," *American Economic Journal: Macroeconomics* 2 (April 2010), 1–30.

Furlanetto, F. and N. Groshenny, "Mismatch Shocks and Unemployment During the Great Recession," *Journal of Applied Econometrics* (2016).

Leduc, S. and Z. Liu, "The Weak Job Recovery in a Macro Model of Search and Recruiting Intensity," *American Economic Journal: Macroeconomics* 12 (January 2020), 310–43.

Michaillat, P., "Do Matching Frictions Explain Unemployment? Not in Bad Times," *American Economic Review* 102 (June 2012), 1721–50.

Nakajima, M., "A Quantitative Analysis of Unemployment Benefit Extensions," *Journal of Monetary Economics* 59 (2012), 686 – 702.

Stole, L. A. and J. Zwiebel, "Intra-Firm Bargaining under Non-Binding Contracts," *The Review of Economic Studies* 63 (July 1996), 375–410.

Zhang, J., "Unemployment Benefits and Matching Efficiency in an Estimated DSGE Model with Labor Market Search Frictions," *Macroeconomic Dynamics* 21 (2017), 2033–2069.